ILLUSTRATIVE

INDEXED MORTGAGES

SIMULATIONS

COPYRIGHT – CMHC [redacted]

Sobeco

ILLUSTRATIVE INDEXED MORTGAGES SIMULATIONS

Executive Summary

The report provides evidence as to the feasibility of indexed mortgages for non-profit housing cooperatives. It compares the cost of the supply assistance under different combinations of circumstances for conventional mortgages and for Price Level Adjusted Mortgeges (PLAM). The calculations are based on data that reproduce the random fluctuations of real life situations. No assumptions are necessary as to the level of taxes, operating costs or maintenance expenses of the units since they are not modified by differences in the mortgage plan.

A working hypothesis is that, as a group, the cooperatives will support a pooling arrangement to buffer individual fluctuations and limit the subsidy required to enable them to meet market rents. Such pooling arrangement is also expected to reduce the risk of default. The study provides estimates of the cost of the pooling arrangements and of its cash flow characteristics as well as comparison of exposures to the risk of default under the different mortgage financing plans.

Four subsidy formulas are compared:

V: an amount varying annually, equal to the difference between mortgage payments and net market rents;

F: an amount set initially equal to the difference between mortgage payments and net market rents, decreasing annually by the difference between the rate of increase in mortgage payments and in net market rents;

L: a lump sum equal to a percentage of the initial property value;

C: a combination of the two preceding formulas;

using alternative assumptions as to the average rate of increase of the local market rents and as to the expected fluctuations in that rate.

The study demonstrates that the cost of the pooling arrangement is acceptable and generally less than 5% of the initial property value. It shows that given a pool fund and a proper design of the subsidy formula, indexed mortgages are feasible, require a much lower subsidy, allow a better fit between coop rents and market rents, without increasing significantly the risk of default.

On a weighted basis, taking into account the average unit cost in different areas and the local market rent levels, the required subsidy for an average unit of $64,523 is reduced by $7,500 to $15,000, that is by 30% to 40%, without a measurable increase in the required insurance premium assumed to be 3% of the initial property value, if PLAM rather than conventional mortgages are used.

The study also illustrates the sensitivity of the results to some of the parameters in order to facilitate the optimization of the program design.

Sobeco Group Inc.

Édifice Sobeco, 505 Dorchester Blvd. West
Montréal, Québec H2Z 1Y7 Tél.: (514) 878-9090
Telex: 055-61914

January 6 , 1986

Mr. Barry Lacombe
Vice-President
Policy Development and
Research Sector
Canada Mortgage and
Housing Corporation
Montréal Road and Eastern Parkway
Ottawa, Ontario
K1A 0P7

Dear Mr. Lacombe:

Attached is our report on the feasibility of PLAM Mortgages for Cooperative Housing Projects and on the appropriate level of pooling fees or insurance premiums. The report also reviews alternatives to optimize the functionning of the supply assistance program. Detailed simulation results and summaries are appended.

We will be pleased to discuss our report with you at your convenience.

Sincerely yours,

Yves Guérard

Yves Guérard

dh

encl.

CMHC-1

86-01-06

ILLUSTRATIVE INDEXED MORTGAGES SIMULATIONS

Table of contents

		Pages
I-	Introductory notes	1 - 5
II-	Description of simulations	6 - 18
III-	Analysis of the results and recommendations	19 - 24

Appendix A:

List of summary results

Appendix B:

List of detailled illustrations

Sobeco

I- INTRODUCTORY NOTES

The following note describes the rationale, the assumptions and the calculations made to answer, at least partially, the questions raised with regard to the feasibility of indexed mortgages for non-profit housing co-operatives.

Illustrations have been constructed to capture the essential economic elements of the financial operations of such co-operatives under various combinations of circumstances. A working hypothesis is that a cooperative will benefit from a government subsidy during an initial period and that, as a group, the cooperatives will support a pooling arrangement to buffer the individual fluctuations. The results obtained when various subsidy and pooling formulas are used are then compared for conventional and indexed mortgages. The main features and various working hypothesis are analysed below.

The rationale: better fit, greater self-help.

In the particular circumstances studied, it is assumed that the co-operatives will, at best, collect the market rents for the units they develop. They could collect less because of various factors:

- the total of the financial charges and of the operating costs falls below market rents;

- the tenants cannot afford high or unexpected rent increases as fast as would be necessary to meet the financial charges without unduly increasing the risk of withdrawal;

- outside constraints, such as rent controls, can affect the increases that are acceptable;

The flat amortization costs of a conventional mortgage result, in current circumstances, in project costs that initially push the economic rent much above market. The Government is called upon to subsidize the difference. Later on, the economic rent falls below market, for the benefit of the current co-operators. The Government cannot recover from future tenants the subsidy given to earlier tenants who paid market rent. However, lower basic co-op rents may reduce the housing cost and therefore the assistance to be given to low income families.

The rising amortization payments of a PLAM mortgage reduce the subsidy required to meet market rents initially and maintain economic rents closer to market rents in later years. Because of the better fit, higher contributions should be collected from co-op members towards the financial costs of their own housing. This higher level of self-help reduces the Government subsidy while allowing the units to remain self-supporting. In the illustrations different rules are applied to simulate the evolution of the coop rent under different circumstances.

A measure of the risk

However, as PLAM mortgages result in higher outstanding loan balances over a greater number of years, they may increase the risk of default and of losses on forfeitures by comparison with conventional mortgages. One may speculate that in some circumstances, those additional costs could cancel any expected saving from the better fit between amortization costs and market rents. This is of particular concern because there is no initial equity contributed by the co-op members which means they would not lose much by walking away towards housing offered to them at market rents. Hence, a common interest has to be created in lieu of personal equity, by "guaranteeing" that rents will meet market levels now and, most likely, will be below market later. Such "guarantee" results from the subsidy formula and the pooling arrangements.

The local rent proxy

The operating expenses, taxes, maintenance fund, etc. have been assumed to remain equal under each financing plan and, consequently, they have been taken out of these simulations by using net market rents, reflecting only the financial costs, which for the co-op includes fees, pool costs and insurance premium.

Assuming a 35 year amortization period for a conventional mortgage, the required monthly payments vary with the rate of interest. Within reasonable limits, a rate of interest can be found that will produce monthly payments equal to a predetermined rent. To simplify the presentation of the illustrations, we have used this rate of interest as the proxy which identifies a given level of local net market rent. The proxy is the rate of interest that makes the market rent equal to the economic rent under a conventional 35 year mortgage, on the net basis.

The proxy corresponding to the net market rents in various areas used in this study are as established and calculated by CMHC. Sensitivity tests have been made by varying the proxy around the observed values. In successive years, local market rents are assumed to vary in accordance with a Rent Index.

The initial level of the proxy is indicative of the gap between the real cost of conventional mortgages and the part of the economic cost that is actually reflected in market rents. Some of the gap can be explained in various ways:

- the cumulative effect of rent controls
- market forces resulting from qualitative differences or from the lower costs of older building
- an implicit capitalization of interest costs by developers that assume future inflationary increases in rent or property values
- the effect of fiscal preferences for investment in MURB, etc...

Subsidy formula and pooling arrangements

A further assumption is that initially the co-operative succeeds in assembling members ready to pay the market rents (except for those that are assisted). This seems reasonable given their expectation that rents will eventually stabilize below market and that the quality of the accomodation will be better than other local housing. However, circumstances may change adversely and to keep its members, the co-op may have to maintain the rent, temporarily, below market so that it remains affordable, even though financial costs are currently higher.

The rules used to project the co-op rents reflects various constraints that are likely to affect the amount the co-op will be able to collect without an unaffordable decrease in its membership.

If the government responsability is limited to enabling the coop to charge market rents, any imbalance due to a temporary lack of cash flow by members should be self-supporting. Under each financing plan a pool is created, either a Revenue Guarantee Fund or a Stabilization Fund, from which the co-operative can borrow to meet temporary difficulties. Various subsidy formula are compared in the illustrations. The Stabilization Fund is lower under Formula L because another mechanism is provided: the extension of the amortization period by a maximum of 5 years.

The premium required to fund the pool is added to the initial mortgage loan. The illustrations test the sufficiency of the premium and the solvency of the pool fund in combination with various subsidy formulas.

15% assistance

In some illustrations the comparison of project costs with market rents takes into account the assistance given to 15% of the units in the form of a discount varying linearly from 0% to 40% of market rents.

Depending on the subsidy formula the cost of the assistance can increase indirectly the Government subsidy or it can be supported directly by the other members of the co-operative then also enjoying below market rents or indirectly by all co-op members, through the pool. Since the assistance is in the form of a discount distributed linearly, of between 0% and 40% of market rates, it diminishes gradually from a maximum of 3% of aggregate market rents as the co-op rents decrease below market and disappears when all tenants pay rents at 60% of market or less.

The required subsidy level

A basic variable that must be compared is the cost to the government of enabling the co-operative to meet market rents by subsidizing the initial interest costs. This cost is minimized if coop rents are allowed to remain as close as possible to market rents.

Part of the difference in costs may arise from the assumption made that PLAM funds can be obtained cheaper by paying an interest rate of 4 1/2% plus inflation because the lender will not charge a risk premium for unexpected inflation. In fact, different assumed market rates for conventional mortgages and assumed costs of interest for indexed mortgages can result in a positive or negative contribution from that assumption, independently of the shift of costs from government to co-op members. These two contributions have been separated by running one year term conventional mortgages with a variable annual interest cost of 4 1/2% plus inflation.

Insurance premium

In the rare circumstances where the pool limit is reached, the claim cost has been assumed to be the then outstanding loan. It is realized this is not a sufficient measure of the insurance premium because default could be triggered in other cases by special economic environment while in all circumstances the actual loss could be more or less than the outstanding loan taking into account settlement costs.

An alternative measure of the extent to which the exposure to risk is different has been proposed. This measure is the sum of the present values of the excess of the outstanding loan over 75% of the projected property value. It is equivalent to assuming a negligible loss when the ratio is below 75% and a loss proportional to the excess when the ratio is above 75%.

Given the interconnection between the exhaustion of the pool limit and the risk of default, increasing the pool support should decrease the risk of default. For a given total cost in terms of pool and insurance premium, there is an optimum split between pool coverage and insurance coverage. That optimal equilibrium should be in the direction of a higher pool premium since it preserves the possibility of self-help and the continuous functioning of the unit. To help establish that equilibrium, we have illustrated the pool cost in excess of the agreed limit. This excess cost can be compared with the estimate of the default cost given by the percentage of the initial mortgage loan still outstanding when the pool limit is reached.

Limitations

It must be stressed that in view of the time constraints, we have made use of some postulates which this study is not attempting to demonstrate. Since the simulations are based on a limited sample of data, which has not been established as a statistically valid basis, there is no pretention to an absolute proof of the feasibility of the particular mortgages plans nor to an accurate determination of the suitable level for the subsidy, the pool premium or the insurance premium. However, being based on actual data, not on artificially smooth assumptions, the illustrations are indicative of the relationships between the results obtained in similar circumstances through different financing approaches. Therefore they give a valuable insight into the working of each plan from which its merit and feasibility can be appreciated.

II- DESCRIPTION OF SIMULATIONS

The basic assumptions are shown in bold; alternative illustrations have been produced to test the effects of variations in some of the basic assumptions.

1- Individual illustrations

A- TITLES

CONV: for a 35 year conventional, non-indexed mortgages, with annual payments predetermined on the basis of the current interest rates and the remainder of the amortizations period.

PLAM: for a 35 year indexed mortgage with annual payments increasing at CPI minus a constant tilt (**2%** or 3%).

The Suffix indicates which of the following subsidy formula is used:

Code V: A variable amount equal to the excess, if any, of the mortgage payments over the market rent until it has been nil for two consecutive years; thereafter zero;

Code L: A lump sum equal to 25% of initial property value; in that case, the initial amortization period is 30 years.

Code F: Annual amounts calculated in accordance with tne following formula:

$$F_{i+1} = P(1+INFL-k\%)^{i-1} - R(1+INDEX)^{i-1} \text{ if positive,}$$

where P and R are respectively the first year Payment and local market Rent ; for CONV plans, the P multiplicand is suppressed. The second year subsidy is equal to P minus R and the first year subsidy is set to the same amount.

INDEX is the **CPI rent index** for the area; an alternative is the CPI aggregate index . Parameter k is **2%** or 3% depending on the PLAM tilt that is used.

Code C: The combination of:

i) a lump sum equal to the difference between the initial loan and **the loan** which could be amortized through a conventional mortgage at **6,50%** (or at 6,00%) by a payment equal to the initial local market rent, **plus;**

ii) annual amounts, calculated as in F, above to amortize the remainder of the loan after deduction of the lump sum calculated above.

As an alternative, the lump sum is made equal to the difference between the property value and the value which on the basis of a 6.50% (or 6,00%) proxy would generate a rent equal to the local market rent. This alternative reduces the lump sum subsidy because loadings are excluded but increases the subsequent annual subsidies because mortgage payments remains higher.

Starting year: Projects are assumed launched in the middle of the year indicated, at quinquennial intervals, starting with 1975, so that runs start in all parts of the cycle.

when a "$" appears besides the starting year, all dollar amounts are expressed in constant dollars of the starting year.

Area: one of the areas covered by the Royal Trust Survey or the Statistics Canada index.

Rent Index: The code indicates which index is used:
1: Royal Trust Property Index for House I in each area;
2: **The CPI rent index for the area as published by Statistics Canada;**
3: The average between Index 1 and Index 2;
4: Index 3 plus 1/2%;

Index 1 assumes that rents fluctuate as quickly as prices at which houses are sold; it also results in a cumulative level of increase that tends to be substantially lower than the rent index.

Index 4 retains the fluctuations of Index 3 but produces rents that on the average increase almost as fast as the CPI aggregate index whereas Index 3 increases less than both the CPI aggregate and the CPI rent index.

Property Index: The code indicates which index is used:

1 : **Royal Trust House Index for House 1**
2 : Statistics Canada, New housing price index
3 : The property value is taken in any years as the greater of:

- r times the average between the local market rent and the co-op basic rent.

- r times the co-op basic rent, plus the unused limit in the pool and the unused subsidy, if any..

This formula relates the projected property values to the expected future cash flow. Parameter r is equal to the ratio of the initial property value to market rent and varies with the proxy used.

Market proxy: The interest rate at which the amortization payment for a conventional 35 year mortgage of an amount equal to the initial property value would correspond to the component of initial local market rents which is available to amortize project costs, that is to the exclusion of taxes, operating expenses, maintenance, etc... Proxies used are as follows:

Toronto	4.46%
Montréal	3.11%
Winnipeg	1.27%
Ottawa	5.93%
Edmonton	5.65%
Vancouver	4.54%

Market rents thus established are independent of the loading.

Pool limit: The percentage of the initial property value that can be borrowed from the pool under given circumstances. The **basic limit is 20%.**

B- COLUMNS

% rates of:
Inflation: CPI rate of increase for the year shown;
R.I.: Rate of increase of the rent index for the year shown;
Earn.: Rate of increase of the AIW for the year shown;
CMI: Conventional mortgage interest rate applicable to a mortgage issued or renewed in the year shown.

The annual rates (inflation, earnings and mortgage interest) are those known for years 1967 to 1984; for other years, it has been assumed that the experience of the next 17 years would be the mirror image of the 1967 to 1984 period. For examples, the rates for 1985 are the same as for 1984, for 1986, the 1983 rates are used, etc... Thus the fluctuations occur in the reverse order for the second period; additional periods are constructed similarly.

For the rent and property indexes, a slightly different method is used in order to preserve a proper relationship. The "real" rate of change, i.e. net of inflation, is calculated for the period 1972 to 1984 for which it is known; the rate for other years is obtained by adding this "real" differential to the inflation rate constructed above.

There is no attempt to thus "predict" the rates; the objective is to obtain a longer period of simulation without recourse to an artificially smooth series.

Market rent: The initial annual amount is calculated from the market proxy for the area and is adjusted annually with the selected Rent Index.

Mortgage payments: 12 times the monthly amount required to amortize the loan under each plan. The initial mortgage loan is equal to the initial property value plus the loading, as follows:

	Basic	alt 1	alt 2
Fee	1/2%	1/2%	1/2%
Insurance	3%	2%	3%
Pool	5%	7 1/2%	1%
Total	8 1/2%	10%	4 1/2%

When alternative 2 is used, the amortization period is initially reduced to 30 years and is extended up to 35 years, if needed, before amounts are borrowed from the pool.

In the PLAM plans, monthly payments are calculated from the annual payments by assuming an inflation rate of 8%. Any discrepancy between that expected rate and the real rate shows up in the loan balance and results in a last payment higher or lower than anticipated.

If a lump sum subsidy is granted to reduce the loan, and hence future payments, the amount shown on the first line is the sum of the subsidy and the first payment.

An "E" indicates that the period has been extended under the L subsidy formula.

Co-op basic: 12 times the monthly rent to be charged by the co-op before deduction of any assistance given to low income members, but after deduction of the component required to pay for maintenance, operating expenses, taxes, etc...

Code: The co-op basic rent for the first year is the local market rent calculated from the appropriate proxy. Thereafter, it is the lesser of the amounts calculated using five different rules, the governing rule being identified by a letter as follows:

M - the local market rent for the year; an absolute maximum;

A - the amortization payments for the outstanding loan, plus any the amount refunded to the pool, minus any subsidy applicable in the given year.

E - 25% of earnings, (a proxy for the maximum capacity to pay);

C - basic rent for previous year increased at CPI + 2%, or if greater, CPI + 10% x (the difference between 100% and the % of market corresponding to the rent payable the previous year), to approximate the effect of rent controls;

G - percentage of market rent equal to previous year percentage plus 5% or, if greater, the % borrowed from the pool and not yet refunded, up to 10%, to limit the rate of increase while allowing for greater increases when the gap with market rents is higher.

% of earnings:	The ratio of Co-op basic rent to earnings; first year earnings are conventionally set equal to 4 times the co-op basic rent.
15% assistance:	discount varying linearly from 0% to 40% of market rents, for low-income members, if any.
Pres. Val. of Govt subsidy	The present value of the subsidy payable each year in accordance with various subsidy formulas.
Unused Subsidy Balance	Under F or C formulas, the subsidy for a given year may be higher than the excess of the required mortgage payment over the co-op basic rent which would be set if rule A did not apply. The excess of the annual subsidy over the required mortgage payment is temporarily accumulated at 3 1/2% plus inflation and **does not reduce the co-op rent.** An alternative calculation is made where the co-op rent is reduced to fully absorb the subsidy.
Pool Bal. :	The pool balance available to a given unit is shown at the beginning of the year and starts at the percentage of the initial value shown as the pool limit. It accumulates at 3 1/2% plus inflation.
	It is assumed implicitly that the co-op income is always sufficient to meet at least the operating expenses, taxes, etc...so that the net rent shown is always positive.
	When the co-op basic rent is lower than the mortgage payments, the difference is borrowed from the pool except if there is still an unused subsidy. In the affirmative, the unused subsidy is utilized first. Subsidy formula L further provides that, before a claim is made to the pool, the mortgage payments are reduced by lengthening the amortization period to a maximum of 35 years.
	If a claim has been made to the pool in previous years, the basic rent, in future years, is increased to the extent possible, above amortization payments to reimburse **75% of the loan with interest,** as fast as possible, except for subsidy formula L where the percentage is 100%.

Whenever a claim is made against the pool, an asterisk appears; if a reimbursement is made, a "R" appears.

After the pool limit is exhausted, the project fails when it cannot meet the amortization payments. However, the illustrations are continued as if the project did not fail and the additional amounts claimed from the pool are shown as negative figures, the total of which is kept separate and not counted as claims against the pool limit nor in the pool cash flow.

Loan Bal. : The loan balance amount is shown at the beginning of the year but after substraction of any lump sum subsidy. The outstanding loan earns interest at the conventional mortgage rate for the year, (CMI) or at **4 1/2%** (or 4%) plus inflation (at the rate for the calendar year during which the loan year begins), as indicated at the bottom. It is decreased by the prescribed payments. In the PLAM plans, the balance may fluctuate around the expected amount because of differences between the assumed 8% rate for compounding within the year and the actual inflation rate for that year's payments.

% of value : The value of the property is projected with the property index. The percentage compares the outstanding loan with the currently projected property value.

Pres. Val. of > 75% exposure: The fraction of the loan that is above 75% of the property value is calculated for each year such an excess exists. For the purpose of calculating that excess, the loan is first reduced by the pool balance and the unused subsidy, if any.

C- <u>TOTAL</u>

Next to TOTAL are shown the average rates compounded annually that correspond to the four "% Rate of" shown in the headings.

Under LOAN BAL. is shown the balance at the end of the last year assuming the full annual payment made. Thus, in the PLAM plans, there may be a small positive remainder while a negative amount indicates the last annual payment would be reduced.

D- ADDITIONAL NOTES

Additional notes appear at the bottom of the page to identify possible variations. They are defined as follows:

Tilt: **None** for the conventional mortgages; **2%** or 3% for the PLAM plans, that is annual payments increase at CPI minus TILT%. The term of the loan is assumed to be one year in all cases, so payments change annually.

Initial property value: Assumed property value per unit varying as follows:

Toronto	$65,717
Montréal	$49,858
Winnipeg	$66,989
Ottawa	$60,380
Edmonton	$62,754
Vancouver	$75,827

Mortgage Loan: The initial loan as a percentage of the property value, including the loadings for fees and premiums for insurance or pooling arrangements.

Initial capital grant to reduce payments to market rent: The amount by which the initial loan should be reduced so that the co-op could meet the mortgage payments in the first year by charging market rents. This amount is for information only; it can be compared with the P.V. of Government subsidy.

Initial capital grant to adjust to 6.50%/6.00% gross/net: The amount to be subtracted from the initial loan or property value so that the initial market rent is reduced to the economic rent at an assumed interest rate, that is become equal to the amortization payment required for a 35 year conventional mortgage at **6.50%** (or 6.00%) compounded semi-annually. **"Gross"** indicates that loadings included above in the mortgage loan are taken into account and "net" is shown when the calculations are based on the net property value.

Earnings: "AIW" or "AIW - 1%" is shown when the earnings have been projected at **the AIW rate of increase** or at that rate minus 1%, respectively.

Interest rate: Mortgages are calculated at 4 1/2% (or 4%) plus inflation or at the CMI rates, as indicated.

Present value at: Present values or accumulations of the pool and of the unused subsidy are made at 3 1/2% plus inflation.

Monthly compounding: Interest rate used to discount monthly payments within each year. Taken as the CMI rate or calculated on the basis of an expected inflation rate of 8%, as indicated.

Average annual rate of interest: The rate compounded annually that is the geometric average of the rates used from year to year.

Present value average annual rate: As above.

(These two average rates are somewhat different from the average inflation rate plus 3 1/2% or 4 1/2%).

2- Summary tabulations

For each plan and each initial market rent level, a tabulation is made across all areas and starting years to find the distribution of the results. Each such combination is deemed a sample of various possible experiences each having an equal probability but the weight given to each area, to calculate the averages, is as follows:

Toronto	0.312
Montréal	0.243
Winnipeg	0.022
Ottawa	0.076
Edmonton	0.036
Vancouver	0.311
Total	1.000

The resulting average initial property value per unit is $64,523 in these illustrations.

FIRST PAGE

The results are tabulated for each quinquennial interval and for the total.

Co-op basic in % of market: This table distributes, on each line, the percentage of cases where the basic rent charged by the co-op, is 100% of market, within 15% to 30% of market, and more than 30% below market.

This helps in assessing the stability of the co-operative membership since below market rents are a definite attraction.

Average Pres. val. of 15% assistance: Where no amount is shown, it is assumed that the assistance given, if any, is channelled through other means.

Average Pres. val. of Gvt. Subsidy: The weighted average of the present value of the Government subsidy used in each period, per unit.

Number of pool users re-imbursers: Number having borrowed once or more against the pool during the period or having made a re-imbursement.

Average pool % used: The amounts borrowed from the pool, before reaching the limit, are distributed per period in percent of the aggregate initial property value. Negative percentages indicate net recoveries during the period.

Number reaching pool limit: Gives the distribution of "defaults" as defined in this study.

Average % excess over pool limit: Amounts that it would have been necessary to borrow after the limit has been reached to avoid defaults.

Average Pres. val. of 75% exposure: Gives the distribution of the amounts used as an index of the risk exposure per unit of initial value. The totals are the sums of the present values for each year in the period and are not to be confused with the average claim which would be based only on the exposure at a given moment. The average yearly exposure would correspond to the total divided by 35 or, alternatively, by the number of years over which some exposure persist. In geometric terms, the amounts shown correspond to the surface of the rough triangle representing the exposures as they decrease over the years while in any year, the potential claim would be only the height of the triangle.

Notes of first summary page:

Tilt: None for conventional mortgages; 2% or 3% for PLAM mortgages.

Averages:

a) The average annual rates shown are the arithmetic averages of the geometric average rates shown on the TOTAL line for the individual cases.

b) The average present values shown for the market rent, the mortgage payments and the co-op basic rent are calculated using the areas weights.

Total outstanding balances when pool limit reaches: Sum of outstanding loan balances when pool limit is reached and the present value of such balances.

In % of initial mortgage: This measures the potential maximum claims in percentage of initial mortgages and can be compared to mortgage insurance premium levels.

Average initial capital grant to reduce payments to market rent: The weighted average per unit.

Average initial capital grant to adjust to 6.50% (or 6.00%) gross(net): The weighted average per unit.

Number of observations: The number of combinations of different starting year and areas combinations.

Initial value per observation: The weighted average initial property value.

Loading: The excess of the initial mortgage over the property value.

Weights, Initial value, Market proxy: Under the name of each area are shown the corresponding parameters used for a given run. (If none are shown, the basic values are those used).

SECOND PAGE

The following results are tabulated for each year and for the total.

Basic co-op Rent based on: This table shows the percentage of the units for which the specific rule (M, A, E, C or G) is controlling the basic rent charged by the co-op in each year and for all years.

% Loan balances below 25%, 50%, 75% of property value: The percentage of the units for which the loan balance is below the given percentage. On the total line is shown the average number of years elapsed before the loan reaches the given percentage for the last time. The loan balance used for this calculation is not reduced by the unused pool or subsidy.

Govt. subsidy below 50% co-op Termi-nated: The percentage of the units for which the government subsidy in the year is:

a) below 50% of co-op basic rent; that is, the Government is contributing less than $1 for each $2 of rent paid.

b) terminated; that is, to exclude trivial amounts, below 0.1% of initial property value.

On the total line is shown the average number of years:

a) until a unit reaches the 50% level;
b) until the subsidy is terminated.

Average pool Cash balance:

The average amount per unit remaining in the consolidated pool fund at the beginning of the year for the 30 observations comprising a given run.

The initial premiums paid are accumulated at 3 1/2% plus inflation and borrowings are assumed to be withdrawn at the middle of the year.

On the Total line is shown the remainder at the end of the last year, which measure the redundancy or the short-fall in the pool premium.

If that amount is positive and greater than the "average excess over pool limit", expressed in dollars, it means that the pool premium would have been sufficient to provide for unlimited coverage, assuming no behaviorial changes.

Average unused Subsidy:

The average amount of subsidy not yet used, if any.

III- ANALYSIS OF THE RESULTS AND RECOMMENDATIONS

To reduce the number of combinations a set of assumptions, the basic assumptions has been used for most of the illustrations. The results of different subsidy formulas can then be compared, other things being equal. Specific assumptions are also varied to test the sensitivity of the results to given parameters.

While individual illustrations have been produced, their direct analysis would be time consuming. Reviewing of a few of them however is very useful to gain an insight into the workings of the model. The analysis has been facilitated by reducing the significant information to two summary pages per combination. A combination is a run made on the basis of a particular mortgage financing plan, a subsidy formula and a given set of assumptions. Combinations that vary only by the mortgage financing plan are given the same run number; thus a run number identifies a given set of assumptions and a subsidy formula.

Selected summary results

Although a greater number of features can be compared, depending upon the particular information sought, some results appear more fundamental.

Rent levels

The first page makes it possible to compare the average present value of market rent and the average present value of mortgage payments.

Variations in the mortgage payments reflect the various financing plans. In the general case, full market rents are seen to be insufficient to cover the mortgage payments, which indicates that even under the best scenario some subsidy would be required. The importance of the assumption made as to the evolution of the market rents is translated into variations of their present value.

The gap between coop rents and market rents is a significant measure of the efficiency of various subsidy formulas. However, there are qualitative aspects to that gap that can be appreciated from the distribution table of coop rent in % of market. Indeed, a gap resulting from a great number of "below 70%" rent is indicative of waste. On the other hand, too many "100%" rents may indicate potential instability in the membership of the coop. The ideal result would appear to be a smaller gap, with most rents in the 85 to 99% bracket, which would be indicative of a better fit.

Interest costs

The basic assumption is that PLAM financing would be obtained at 4 1/2% plus inflation. However, it appears that this rate results in a higher interest cost than the CMI rates obtained during the period covered by the statistics. Illustrations have also been run assuming PLAM financing at 4% plus inflation, which approximates more closely the real interest costs.

Cost differences between conventional mortgages and PLAM should be estimated by comparing with the costs for conventional mortgages at an assumed interest rate of 4 1/2% plus inflation which have been provided for that purpose.

Pooling operations

Various results can be compared. First of all, the pool used can be compared with the pool premium included in the loading. Fine tuning of the pool premium would require an iteration process as a decrease in the initial premium reduces the pool costs and vice versa. The table on the second page indicates the reason for a claim against the pool, which occurs when one of the rules other than A governs the rent.

A positive margin is obviously desirable but it would be deemed unfair if too high unless some experience rating of the pool premium is provided. As the ultimate cost is largely governed by the first 15 years, the experience rating could then start to apply and offset, to a degree, the reimbursements payable, if any.

The fact that, in many cases, the assumed pool premium is sufficient to cover the excess over the pool limit is a significant information. In most such cases, the excess pool cost is lower than the default cost shown as % of initial mortgage, which is to be expected because favorable fluctuations can occur after the default point is reached. It indicates that if some mechanism was provided to keep the units functioning, even after they have exhausted the pool limit, insurance costs could be further reduced. Obviously, removing the limit unconditionally would result in behaviorial changes that are not captured by the simulations.

On the second summary page is shown the pool cash balance per unit. It should be realized that the accumulations are by common duration: year 1 is credited simultaneously with the premium from all starting years (1975, 1980, 1985, etc...) and charged with all first year claims. Similarly, year 2 supports claims from 1976, 1981, 1986, etc... In the actual operation of the plan, premiums would be received each year and claim would lag over a longer period. Therefore, in most cases the actual evolution of the cash balance would be more favorable, which could eliminate some of the illustrated overflows even though the ultimate cost would remain unchanged.

The accumulations could be made by matching the calendar years rather than the durations. However, such accumulations would depend on the starting point selected in the cycle. As produced, the accumulations are averaging the interaction of the various cycles.

Risk measurement

Various indicators are provided. In the first one, the present value of the loan in excess of 75% of the property value is established after deducting any unused subsidy and any unused pool limit since those amounts would normally be used up before a default would occur and are an addition to the capacity to pay of the coop members.

A second indicator is the number of years required for the loan balance, to reach 75%, 50% or 25% of the property value. Since in both cases those percentages depend on the property values, different indexes have been used to project the assumed property values.

The third measure is the loan balance, in % of initial mortgage, still outstanding when the pool limit is exhausted. The difference in these percentages for a conventional mortgage and for the corresponding PLAM mortgage in similar runs measures the added risk of default resulting from the tilted payment pattern. It should be adjusted by the various experience factors developed in assessing the status of the mortgage insurance fund by the Department of Insurance Actuary, namely the ratio of the average loss to the accepted amount, before being compared to insurance premiums. With regard to defaults occuring for external causes, some correction should be made reflecting the differences in average exposures.

Subsidy formulas

The basic information is the present value of the subsidy. Roughly, mortgage payments have to be covered by a combination of coop rents, government subsidy and net claims from the pool. The shifting balance between these three components is the key feature of the various runs.

The duration of the subsidy appears on the second page of the summary.

An accessory information is obtained from the comparison of the subsidy with the initial capital grant that would be necessary to reduce the economic rent to the market rent or to a market rent that would be the economic rent at the given interest level.

From a theoritical point of view, the V formula produces very satisfactory results in terms of subsidy s*s, pool costs, default rates and level of coop rents relative to market rents. However, the duration of the subsidy is very long and the exposure index tripled. But the main shortcoming is the difficulty of administering such a formula since it requires an annual determination of the local market rent.

Easier approaches to the subsidy calculation have been suggested. They are illustrated by formulas F and L. In the case of formula F, experimentation has shown that the negative term should be adjusted with the rent index for the area rather than the aggregate CPI and that, to allow for a better fit, the decrease should be lagged one year. Even though the duration of the subsidy remains at nearly 20 years, it would require both a much larger pool premium and insurance premium.

A net advantage of the L formula is the duration of the subsidy which is reduced to one year. However, a percentage higher than 25% would be required to make the pool premium and the risk more manageable. This would increase the wastage in some areas as the lump sum becomes redundant. A lump sum subsidy varying by area would result in a better fit with local market rents.

The C formula was developed to capture the advantages of both the F and the L formula. Obviously, the relative importance of the initial grant and of the annual subsidies can be varied. Some such variations have been illustrated.

First, the lump sum subsidy was made variable with the level of the local market proxy. In the basic formula we used a cut-off level corresponding to an economic rent calculated at 6 1/2%, which approximates the assumed 4 1/2% real rate of interest plus the 2% tilt.

This initial lump sum subsidy is complemented by an annual subsidy of short duration calculated as in the F formula. This complement would reflect the short term evolution of the local market rents which may correct a temporary disequilibrium in the market and allows for some follow-up.

The unused subsidy

Under all but the V subsidy formula, unexpected fluctuations may result in a redundant subsidy for a given year. This would normally drive down the coop rent to a level which increases the likelihood of future claims against the pool. A solution would be to set aside the unnecessary part of the subsidy. However, the administrative difficulties of implementing restrictions on the payment of the promised subsidy are obvious. In our illustrations, we have not assumed that the "unused" part of the subsidy is lost to the unit but merely put aside for leaner years. If the pool premium is experience rated, a practical solution could be to credit the amount to the pool of the given unit thus increasing the potential coverage or the potential premium refund. If administrative rules similar to the rules used in the simulation applies, it would also contribute to smooth out future rent increases.

Alternatively, these amounts can be interpreted as a measure of the spurious oversubsidization resulting from administrative constraints.

Reimbursements to the pool

The illustrations assume that units would re-imburse a percentage of the amounts claimed against the pool, plus interests. The basic percentage used is 75% which provides for some perequation. If the pool premium is 5%, it will be seen that if the 20% limit was claimed, an amount equal to the premium paid would be excused since only 15% would have to be reimbursed. It would have the psychological advantage of avoiding the impression that this 5% is paid twice.

In our opinion, providing for some reimbursement not only reduces the pool costs and eventual risk of default but should also have positive behaviorial effects. The pool will be administered at least in part by representatives of the cooperatives. Refusing a non-refundable claim would be like witholding a gift paid for by the premium; a reimbursement rule justifies a business approach to the amounts claimed since the pool fund becomes a creditor of the unit.

Conclusions

With conventional mortgages, if the interest costs are at 4 1/2% plus inflation, the weighted subsidy costs per average unit of $64,523 vary from about $25,000 to $35,000 depending on the subsidy formula. PLAM financing reduces those costs by 30% to 40%, that is by about $7,500 to $15,000, without a noticable increase in the risk of default and with only a limited increase in the exposure index.

If a subsidy formula similar to formula C is used, the exposure index remains of the same order of magnitude under PLAM as for conventional mortgages.

With regard to the insurance premium assumed to be 3% of the initial property value, the simulations do not indicate that it should be increased because of PLAM financing. Because of the protection offered by the pool, the frequency of the claims does not appear to be influenced significantly by the mortgage plan although, given a claim, the potential amount at risk is somewhat increased.

Since the interest costs could be lower than 4 1/2% plus inflation, it may be advisable under formula C to base the initial subsidy on a 6% rather than a 6 1/2% proxy. It slightly reduces the costs and it increases the rents collected by the coop. The slight lengthening of the subsidy period may also be a positive factor.

In addition to the 25% co-insurance factor, we have suggested an experience rating of the pool costs which would conterbalance any pressure to reduce the initial pool premium. The 5% initial premium used in the illustrations, even though higher than necessary in many cases, appears reasonable given the fluctuations that can be expected. Rent Index 1 overstates the need because it combines sharp fluctuations with a cumulative understatement of observed rent increases. Rent Index 3 and Rent Index 4 show similar fluctuations combined with a different average level of increase and still constitute a more severe test than Rent Index 2.

The illustrations indicate that in many cases some units would fail because of the 20% limit while the pool costs are lower than the assumed 5% premium. A special mecanism could be designed to better utilize the pool balance and reduce the potential for insurance claims. A possibility would be to limit the routine claims against the pool to a 15% or 20% ceiling but allow an extra 10% under special conditions such as to the level of the rent; this additional 10% could carry an 100% reimbursement charge.

Appendix A

List of summary results

Conventional and PLAM

Run number	Subsidy formula	Rent index	Variations
A1	V	2	Basic
2		3	
B1	F	2	Basic
2		3	
3		2	No unused subsidy
4		3	
5		2	Loading 10%
6		3	
C1	L	2	Basic, Loading 4 1/2%
2		3	
D1	C	1	Basic
2		2	
3		3	
4		4	

PLAM only

Run number	Subsidy formula	Rent index	Variations
E1	F	2	Tilt 3% and loading 10%
2		3	
3		2	Tilt 3%, loading 10% and
4		3	no unused subsidy
F1	L	2	Loading 10%
2		3	
G1	C	1	No unused subsidy
2		2	
3		3	
4		4	
H1	C	1	Interest 4% plus inflation
2		2	
3		3	
4		4	
I1	C	1	Subsidy to 6.00% gross
2		2	
3		3	
4		4	
J1	C	1	Subsidy to 6.00% net
2		2	
3		3	
4		4	
K1	C	1	Interest 4% plus inflation
2		2	and subsidy to 6% gross
3		3	
4		4	

PLAM only

Run number	Subsidy formula	Rent index	Variations
L1	C	2	15% assistance
2		3	
M1	C	2	Earnings at AIW minus 1%
2		3	
N1	C	1	Loading 10%
2		2	
3		3	
4		4	
O1	C	1	Proxy increased by
2		2	50% of difference to 6.50%
3		3	
4		4	
P1		2	Tilt 3%
2		3	
Q1		2	Property index 2
2		3	
R1		2	Property index 3
2		3	

Appendix B

List of detailled illustrations

Run number	Subsidy formula	Rent index	Variations
A1	V	2	Basic
B2	F	3	Basic
F1	L	2	Loading 10%
H1	C	1	Interest 4% plus inflation
O4	C	4	Proxy increased